Effect of refrigerated storage, use of hydrogen peroxide and of lactoperoxidase system on some properties of goat milk

A. GÜRSEL, E. BOZBAY
Ankara Üniversitesi Ziraat Fakültesi Süt Teknolojisi Bölümü 06110 Dýþkapý Ankara Türkiye

SUMMARY
In the present study, effect of the refrigerated storage, use of hydrogen peroxide or activation of the LP system on some properties of raw goat milk was evaluated. Goat milk preserved well by using 100 ppm of H_2O_2 or by activation of the LP system with 20:20 ppm SCN^-:H_2O_2 without acidity development at 20°C for 15h. Hydrogen peroxide was found to be more effective for preservation of the milk than the LP system activation at 35°C. Increasing concentrations of hydrogen peroxide resulted in a significant prolongation in rennet coagulation time and a reduction in starter culture activity. Rennet coagulation time of milk prolonged more with the refrigerated storage than with the LP system activation. Effect of refrigerated storage on starter culture activity was less than the effect of the LP system.

BACKGROUND
Cooling is the best solution for extending the keeping quality of milk during storage and/or transportation. This is, however, not feasible in such cases as lack of cooling, high ambient temperatures and distant transportation (Björck et al 1979). Utilization of H_2O_2 or activation of the LP system could be practical alternatives for the preservation of raw milk under these circumstances (Anonymous 1958, Björck et al 1979, Björck 1987). The aim of the present study is to compare the use of H_2O_2 or the LP system with refrigerated storage for their effectiveness on the preservation of goat milk under tropical or subtropical conditions.

MATERIALS AND METHODS
Freshly prepared solutions of H_2O_2 (1%) and sodium thiocyanate (0.5%), commercial liquid rennet (Mayasan/Türkiye), thermophilic lactic culture (Yo-Flex YC 350, Chr. Hansen's Lab., Copenhagen/Denmark) were used in the experiment. Concentrations of H_2O_2 and SCN^-:H_2O_2 were chosen on the basis of the heat stability of goat milk. Raw milk from the herd of White goat (SaanenxKilis cross-breed) maintained at the experimental farm at the Ankara University Faculty of Agriculture, after immediately transporting to the laboratory, was divided into three parts. The first part was chilled to 4°C to be stored for 15h. The second part at 20°C was divided into five portions, and the first one was used as control. The remaining portions were preserved by the addition of hydrogen peroxide at concentrations of 100 ppm and 400 ppm and by activation of the LP system with 20:20 and 60:60 ppm SCN^-:H_2O_2. The third part was preserved at 35°C after being treated as for the second part. The samples were analyzed at 3-h intervals during the storage for 15h. The indigenous and residual thiocyanate contents were determined spectrophotometrically (IDF 1988). Tests for titratable acidity and resazurin index were carried out according to the methods given in a Turkish Standard (1981). Rennet clotting time and starter culture activity were determined by the methods stated by Björck (1987) and Rasic and Kurmann (1978), respectively. A randomized block design was used for the experiment (Düzgüneþ et al 1983) which was replicated two times.

RESULTS
The acidity development was effectively controlled for 15h at 20°C by the addition of 100 ppm of H_2O_2 or 20:20 ppm SCN^-:H_2O_2 to milk. The development of acidity was inhibited more effectively at 35°C by the use of higher concentrations of H_2O_2 or SCN^-:H_2O_2 as previously found by Kamau and Kroger (1984). The milk sample kept at the refrigeration temperature had 1-h resazurin value below 4 after 9 h storage due probably to an increase in the number of psychrotrophic bacteria. The samples treated with 100 ppm of H_2O_2 or 20:20 ppm SCN^-:H_2O_2 were found to be acceptable after 12 h at 20°C having the 1-h resazurin value of 4, while the sample preserved by using 400 ppm of H_2O_2 at 35°C was the only one which had 1-h resazurin value above 4 after 15 h. Preservation of milk at either 20°C or 35°C by the addition of 400 ppm of H_2O_2 caused the most prolongation in rennet coagulation time. On the other hand, refrigerated storage of milk led to longer rennet coagulation time than the LP system activation. Activity of the lactic starter culture decreased significantly with an increase in the level of H_2O_2 at both of the storage temperature. Activation of the LP system resulted in a significant reduction in the activity of the culture than the refrigerated storage of milk.

CONCLUSION
Use of H_2O_2 or activation of the LP system could be alternative methods to refrigerated storage of goat milk as to controlling the acidity development until it is reached to processing centers. Although H_2O_2 has a bactericidal activity much stronger than the LP system as stated by Kamau and Kroger (1984), it could be convenient to preserve goat milk which is intended for being converted into cheese or yoghurt, since the adverse effect of high concentrations of H_2O_2 is more significant than the LP system on rennet coagulation time and starter culture activity.

Anonymous. 1958. Report on meeting experts on the use of hydrogen peroxide and other preservatives in milk. Dairy Sci.Abstr., 20:653.

Björck, L. 1987. Preservation of milk by chemical means. In: Dairy Development in East Africa. Bulletin of the

International Dairy Federation No:221. Brussels, Belgium.

Björck, L., Claesson, O., Schultess, W. 1979. The lactoperoxidase system as a temporary preservative for raw milk in developing countries. Milchwissenschaft, 34:726-729.

Düzgüneþ, O., Kesici, T., Gürbüz, F. 1983. Ýstatistik Metotlarý-I. A.Ü.Ziraat Fakültesi Yayýnlarý:861. Ankara. s.1-229.

International Dairy Federation (IDF). 1988. Code of Practise for Preservation of Raw Milk by Lactoperoxidase

System. Bulletin of the International Dairy Federation No:234. Brussels, Belgium.

Kamau, D.N., Kroger, M. 1984. Preservation of raw milk by treatment with hydrogen peroxide and by activation of the lactoperoxidase (LP) system. Milchwissenschaft, 39:658-661.

Rasic, J.L., Kurmann, J.A. 1978. Yoghurt-Scientific Grounds, Technology, Manufacture and Preparations. Publ. by authors. Distr. by Technical Dairy Publ. House, Jyllingevej 39, DK-2720 Vanlose, Copenhagen, Denmark. p.427.

Turkish Standards Institution (TSE). 1981. Raw milk. TS 1018. Ankara.